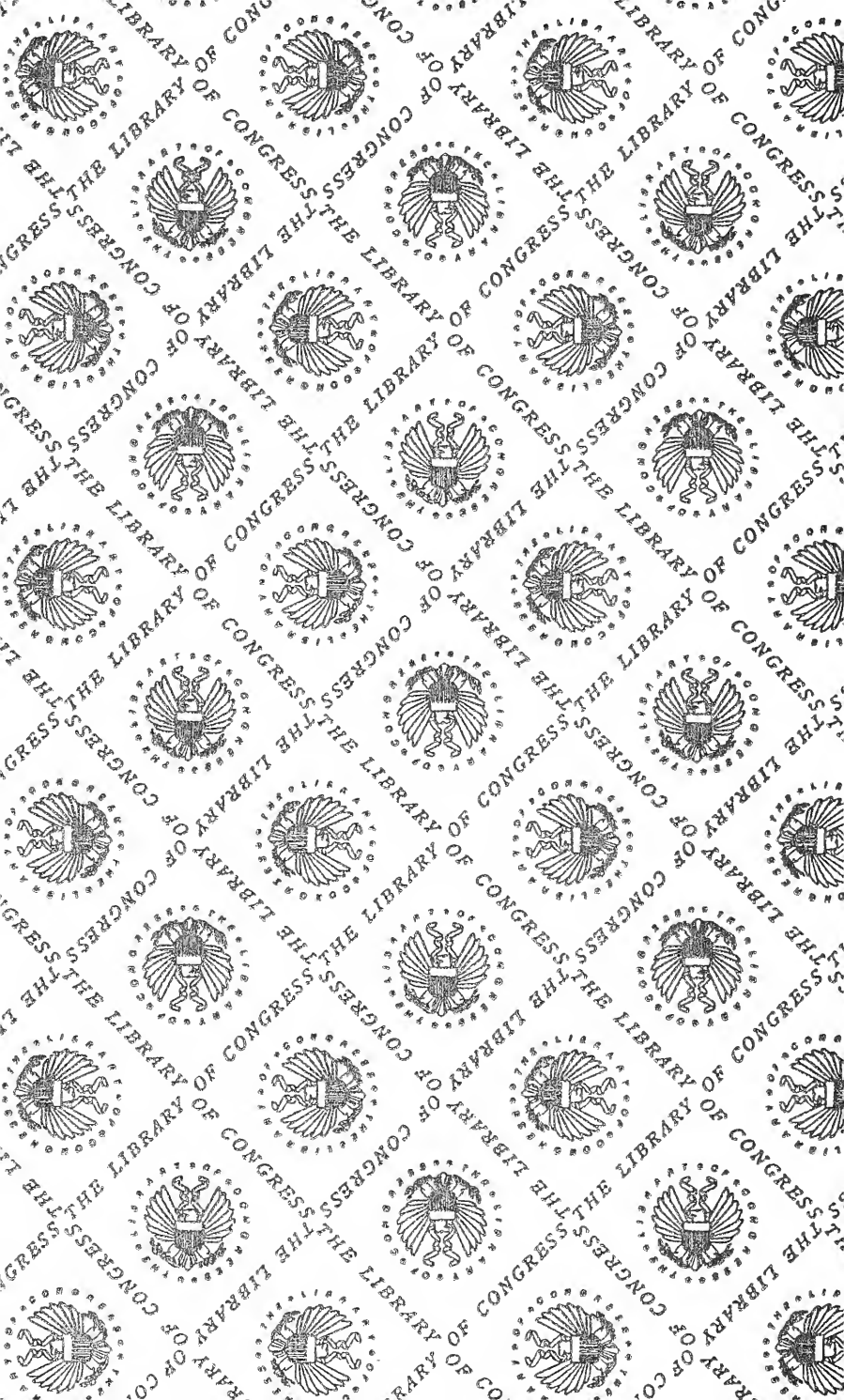
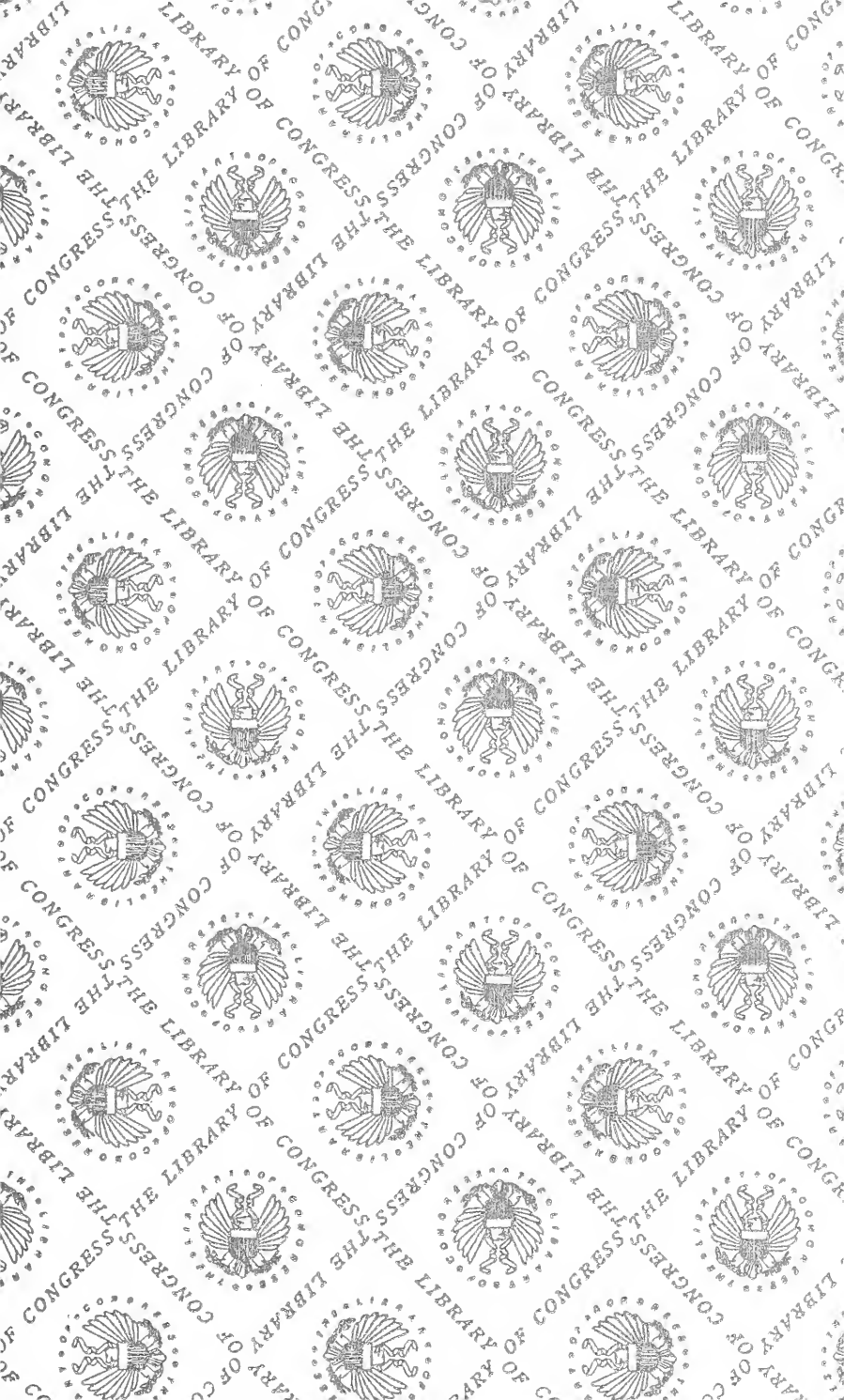


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HOW TO FIGURE OUT AND ARRANGE
PATTERN WORK
FOR WEAVING COLORED FABRICS

EXPLAINED

AND

ILLUSTRATED

TOGETHER WITH
OTHER SIMPLE RULES AND
CALCULATIONS PERTAINING
TO WEAVING DEPARTMENTS

BY J. G. KING, SUPERINTENDENT
ELMIRA COTTON MILLS COMPANY
BURLINGTON, NORTH CAROLINA

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P R E F A C E

Being a practical mill man, and having come in contact with more or less superintendents, boss weavers and boss beamers that are *not* familiar with the methods of figuring out and arranging pattern work to best advantage—which it is quite important to know in order to handle a colored goods mill successfully—the idea was suggested to me, by one that wanted to learn, that I get up a plain and simple book on the subject, together with a few other simple rules and calculations that have proven quite useful to everyone connected with weaving departments; and being aware of the fact that this part of the work was so little understood by so many that *ought to know*, and also in view of the fact that there are scores of second hands, loom fixers, beamer hands, etc., who are in line for promotion who would like to have the information as contained in this book, I have made special effort to get the book up in the plainest and simplest manner possible, avoiding all signs and abbreviations, etc.; or, in other words, I have put the feed way down on the lowest shelf, so that anyone with only a slight knowledge of arithmetic can understand and master it as well as those that happen to be better informed.

I have no knowledge of any such book ever being published on this subject, as herein illustrated and explained, and it is the writer's opinion that it will eventually be appreciated as it becomes known, especially so among those who have never had the opportunity of much schooling or any special textile training.

Respectfully,

J. G. KING.



J. G. KING

INTRODUCTORY

While this book is designed to teach anyone how to work out patterns and arrange them to best advantage in all classes of colored work, checks, dress patterns, stripes, etc., in order to make the illustrations plain, each pattern is illustrated in a stripe; it being understood by all that are likely to be interested that the pattern in the filling of a piece of goods has nothing to do with the figuring out and arranging of the warp ends.

The patterns as shown here are not designed with the view of showing any specially attractive effects, but they were selected because each pattern works out differently; and you will find that practically every question that is likely to come up in working out and arranging a pattern, is brought out and explained in some of the designs as shown in this book.

CONTENTS

CHAPTER ONE

A very simple 2-colored pattern worked out and illustrated.

CHAPTER TWO

Another 2-colored pattern worked out and illustrated.

CHAPTER THREE

A 2-colored pattern worked out and illustrated.

CHAPTER FOUR

A 2-colored pattern worked out and illustrated.

CHAPTER FIVE

A 4-colored pattern worked out and illustrated.

CHAPTER SIX

A 4-colored pattern, with *cord work*, worked out and illustrated.

CHAPTER SEVEN

A 4-colored pattern, with *cord work* and *fancy stripe*, worked out and illustrated.

CHAPTER EIGHT

A 2-colored pattern of Bed-Ticking worked out and illustrated.

CHAPTER NINE

A 2-colored pattern, with *cord work* of *ply yarn*, worked out and explained.

CHAPTER TEN

How to get out Blanket Sheets, worked out and illustrated.

CHAPTER ELEVEN

How to find the Percentage of Sizing on a warp.

To find out how much the cloth will Take-up in *Width* in Weaving.

To find the Take-up in warp in length.

To find the Number of Ends Required in a warp for a given width of goods.

CHAPTER TWELVE

How to figure the Weight of a piece of goods *before* it is woven, plain weave.

How to figure the Weight of a piece of goods with *cord work*.

How to figure the weight of goods *after* they are woven, by pounds, and by ounces.

CHAPTER THIRTEEN

How to find the *weight* of a warp.

How to find the *length*, and how to find the *number* of the *yarn*.

CHAPTER FOURTEEN

Short rules on figuring Percentage of Production.

How to find *Loom Constant*.

How to find *Cloth Constant*.

How to find *Average Speeds* of *Looms* running different speeds.

CHAPTER ONE

. We will take for our first pattern to be worked out a very simple one, as follows:

$$\begin{array}{r}
 8 \text{ black} \\
 8 \text{ white} \\
 \hline
 16 \text{ Total ends in pattern}
 \end{array}$$

In this warp we will say we will have 1400 ends in addition to the selvage, and we will have 32 ends for selvage—16 ends on each side of the cloth; therefore, our total number of ends in the warp will be 1432.

Now in working out the pattern we will simply use the 1400 ends and add the other 32 ends, we propose to use for selvage later.

Our pattern should read as follows:

$$\begin{array}{r}
 8 \text{ ends of black} \\
 8 \text{ ends of white} \\
 \hline
 16
 \end{array}$$

Now the above represents one *complete pattern* and we find we have 16 ends to each complete pattern, and in order to find out how much of each color is required in the warp, we must first find out how many *complete patterns* there will be in the full width of the cloth; therefore, as we are to have 1400 ends in the full width of the cloth besides the selvage, we must first divide 1400 by 16, which will give us the total number of complete patterns, thus:

$$\begin{array}{r}
 16)1400(87 \text{ complete patterns} \\
 \underline{128} \\
 120 \\
 \underline{112} \\
 8 \quad \text{ends over} \\
 (7)
 \end{array}$$

Now we find we have 87 complete patterns and 8 ends over.

By referring to our pattern we find we call for 8 ends of black to each pattern, and as we have 87 patterns we must multiply our 87 by 8 in order to find out how many ends of black are required in the warp, thus:

$$\begin{array}{r} 87 \\ 8 \\ \hline 696 \text{ ends of black required} \end{array}$$

For the white, we get that the same way:

$$\begin{array}{r} 87 \\ 8 \\ \hline 696 \text{ ends of white required} \end{array}$$

Now we take the 696 ends of black and the 696 ends of white and add them together, thus:

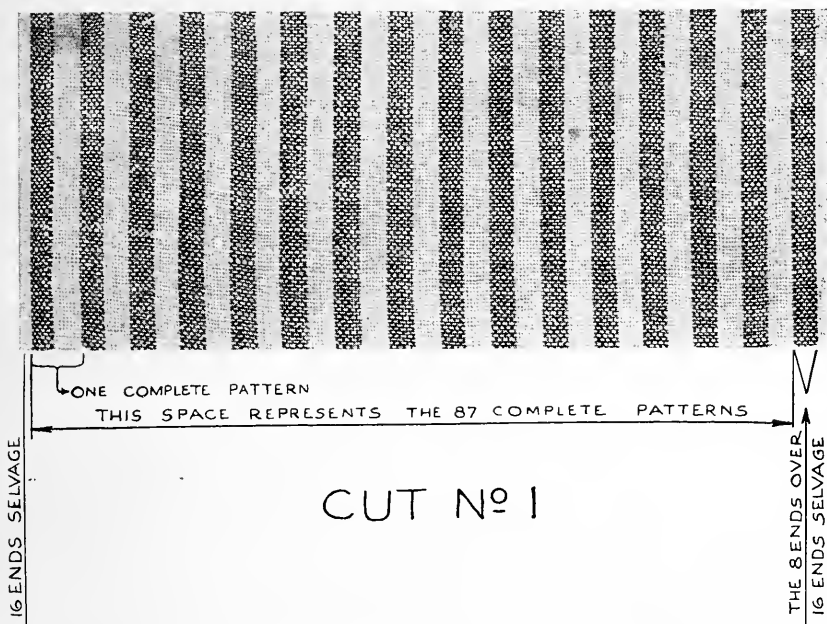
$$\begin{array}{r} 696 \text{ black} \\ 696 \text{ white} \\ \hline 1392 \end{array}$$

Here, we find the total ends of black and white only amount to 1392, and it should be 1400.

Now we refer back to where we worked out the pattern on page seven and we find we have *8 ends over*. This 8 ends added to the 1392 makes the 1400. Thus:

$$\begin{array}{r} 1392 \\ 8 \\ \hline 1400 \end{array}$$

Now the next question is, which color should these 8 ends be added on to? One might suppose that as the pattern calls for just as much white as it does black, that we should divide it and add 4 ends on each color; but that would not be right. By referring to cut below this will possibly be more clearly understood.



This cut Number 1 is supposed to represent the cloth in the pattern we are working on, and you will notice that we have 8 of black next to the selvage on both sides; therefore, we have one more black stripe in the total width of the cloth than we have of the white, and as we have 8 ends of black to each stripe we will add the 8 ends we have over onto the black, making it read as follows:

$$\begin{array}{r}
 704 \text{ ends of black} \\
 696 \text{ ends of white} \\
 \hline
 1400 \\
 32 \text{ ends of white for selvage} \\
 \hline
 1432
 \end{array}$$

In this case it is important that we add the 8 ends on the black so as to make both sides of the cloth look alike, as shown in cut Number 1; and in order to make it clear to the beamer hand or slasher man, when he commences to lay in this warp, it should be written as follows:

End here	8 black	Total Ends
	8 white	704 black
	—	728 white, selvage included
	16	—
		1432

87 patterns. Selvage 16 ends on both sides.

The point marked "*End here*" shows the beamer or slasher man just how the last pattern should come out when he lays in the warp, and if it does not come out as marked it proves that he has made a mistake in laying in, or that there is a mistake in the number of ends in the warp.

CHAPTER TWO

Now we will take up another pattern similar to the first one, as follows:

16	black
16	white
<hr/>	
32	ends in pattern

In this pattern we will use 1400 ends besides the selvage, just as we did before. But, in order to find out how many complete patterns there will be, we must divide the 1400 ends by 32, as that is the number of ends to each complete pattern in this warp.

32)	1400	(43 complete patterns
	128	
	<hr/>	
	120	
	96	
	<hr/>	
	24	ends over.

Now we have 16 ends of black to the pattern, and as we have 43 complete patterns we must multiply the 43 by 16 to find out the number of ends of black required:

43
16
<hr/>
258
43
<hr/>
688 ends of black

And as we have 16 ends of white also to the pattern we find the required ends of white the same way:

43
16
<hr/>
258
43
<hr/>
688 ends of white

Now we add together the 688 ends of black and the 688 ends of white, as follows:

$$\begin{array}{r} 688 \text{ black} \\ 688 \text{ white} \\ \hline 1376 \end{array}$$

Here we find we have only 1376 ends, when we should have 1400. By referring back to where we worked out this pattern, we find we had *24 ends over*, and by adding the 24 ends to the 1376, thus:

$$\begin{array}{r} 1376 \\ 24 \\ \hline 1400 \end{array}$$

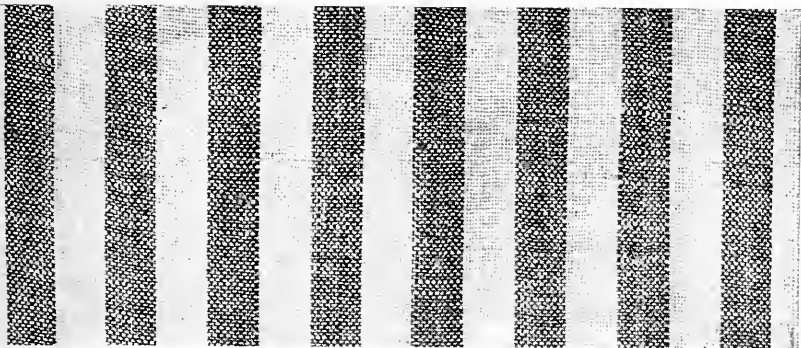
we find we have our correct number of ends.

Now the next question is, which color should we add the 24 ends onto? In this case, we would not want to add it all on the black as we did in the first pattern, but in order to make both sides of the cloth look alike we should add 16 ends on the black and 8 ends on the white. The 8 ends added on the white should be included in the selvage, making 20 of white on each side for this pattern, which would read as follows, and the cloth would show up on both sides like Cut Number 2:

End here	16 black	Total Ends
	16 white	704 black
	<hr/>	728 white, selvage included
	32	<hr/>
		1432

43 patterns. 20 selvage on both sides.

20 ENDS SELVAGE



ONE COMPLETE PATTERN

THIS SPACE REPRESENTS THE 43 COMPLETE PATTERNS

CUT N^o 2

THE 16 ENDS OVER

20 ENDS SELVAGE

CHAPTER THREE

Suppose we take another pattern with 1400 ends, same as the first two we have just gone over, but have this one read as follows:

$$\begin{array}{r} 20 \text{ black} \\ 20 \text{ white} \\ \hline 40 \text{ ends in pattern} \end{array}$$

We will work this one out just the same way as the first two, as follows:

$$\begin{array}{r} 40) 1400 (35 \text{ complete patterns} \\ \underline{120} \\ 200 \\ \underline{200} \\ \hline \end{array} \quad \text{and nothing over}$$

We have 20 of black, also 20 of white, to each pattern, so we proceed to find the required number of ends of each color as before:

$$\begin{array}{r} 35 \\ 20 \\ \hline 700 \text{ ends of black} \\ \\ 35 \\ 20 \\ \hline 700 \text{ ends of white} \\ \\ 700 \text{ ends of black} \\ 700 \text{ ends of white} \\ \hline 1400 \end{array}$$

In this case, our total number of ends comes out just right, but if we let our pattern go through, without any change, our cloth will show up like Cut Number 3, which you will admit, I am sure, will not show up to best advantage, as both sides are *not* alike.

16 ENDS SELVAGE

ONE COMPLETE PATTERN

THIS SPACE REPRESENTS THE 35 COMPLETE PATTERNS

16 ENDS SELVAGE

CUT №3

16 ENDS SELVAGE

CUT №4

16 ENDS SELVAGE

This pattern, however, should be written as follows, and in that case it would show up on both sides alike, as shown in Cut Number 4:

Start with 10	20 black	Total Ends
End with 10	20 white	700 black
	—	732 white, selvage included
	40	1432

35 patterns. 16 ends selvage on both sides.

The above marking means: Start the *first* pattern, when laying the warp in on the beamer or slasher, with 10 ends of black instead of 20, and the *last* pattern will come out with 10 ends of black on the other side, as shown in Cut Number 4.

CHAPTER FOUR

We will take the following pattern: .

16	black
2	white
4	black
2	white
<hr/>	
24	ends in one pattern

Here we have 24 ends to each pattern. Considering our warp to have 1400 ends, besides the selvage, as before, we of course follow the same rule in working out the pattern:

24)1400	(58 complete patterns
120	
<hr/>	
200	
192	
<hr/>	
8	ends over

Now we have 20 ends of black to the pattern, so we multiply the 58 by 20 to find out how much black is required:

58
20
<hr/>
1160

ends of black required.

We have 4 ends of white to the pattern, so we multiply the 58 by 4 to see how much white is required:

58
4
<hr/>
232

ends of white required

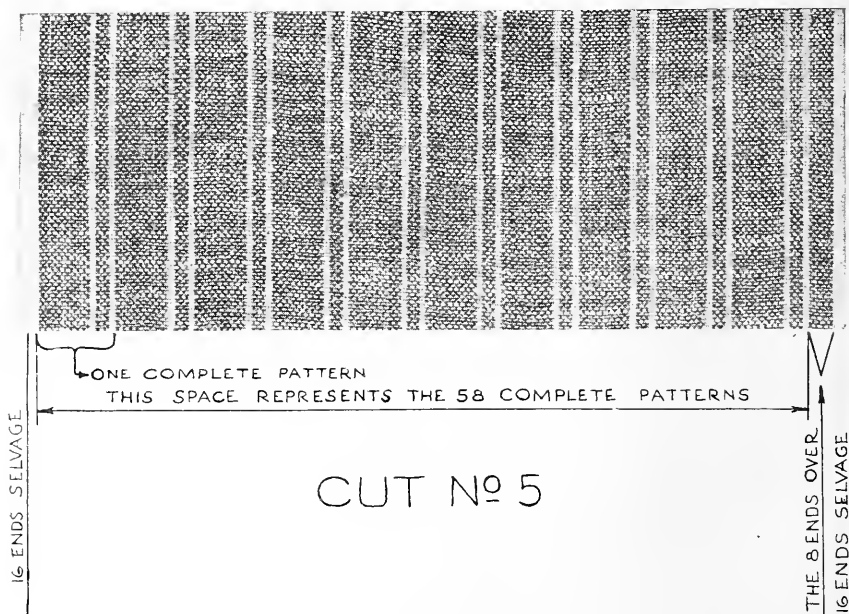
Adding the 1160 ends of black to the 232 ends of white, we have

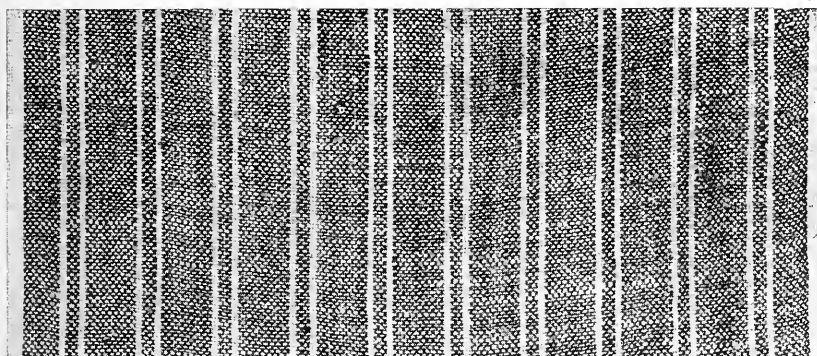
1160
232
<hr/>
1392

and by adding the 8 ends we have over, to the 1392, we find we have the correct number of ends—1400; or, in other words, it proves our example to be correct.

Now we must find out the right place to put these 8 ends we have over, and also know how it will show up in the cloth next to the selvage.

In reading over the pattern, we find we commence at the top and read 16 of black and at the bottom of the pattern is 2 of white, while of course every time you read the pattern over you start at the top 16 black and wind up at the 2 of white at the bottom. Well, now, we will just suppose that we have read the pattern over 58 times, which is the number of complete patterns we have in this warp. Now you will understand we have 58 patterns and 8 ends over, so when we start over the pattern the 59th time we are counting the 8 ends we have over, and when we get as much as 8 ends of black on the 59th pattern we have used up all our 1400 ends, so you see the 8 ends we have over will come on the black; therefore our warp, when laid in on the beamer or slasher, would show up 16 black next to selvage on one side and 8 of black next to selvage on other side, as shown in Cut Number 5.





CUT N^o6

16 ENDS SELVAGE
12 ENDS BLACK

12 ENDS BLACK
16 ENDS SELVAGE

While the difference in appearance in this particular pattern on each side, is not very noticeable, and would make but little difference in the general appearance of the goods, yet it is just as easy to have both sides alike, which always looks better, so we will arrange the pattern accordingly and the cloth will show up on both sides as shown in Cut Number 6, and the pattern should be marked as follows:

Start with 12	16 black	Total Ends
End with 12	2 white	1168 black
	4 black	264 white, selvage included
	2 white	
	<hr/> 24	<hr/> 1432

58 complete patterns. 16 ends selvage on both sides.

CHAPTER FIVE

Now we will take a pattern having 4 colors, as follows:

This much towards the 37th pattern.	{	14 blue 2 white 2 red 2 white 2 red 2 white 4 black 2 white 2 red 2 white 2 red 2 white	}	36 complete patterns in the width of the cloth
Ends here	{	38	}	total ends in pattern.

In working out this pattern we will follow the same rule and methods as before, using 1400 ends in the warp in addition to the selvage:

$$\begin{array}{r}
 38) 1400 \text{ (36 complete patterns)} \\
 \underline{114} \\
 260 \\
 \underline{228} \\
 32 \text{ ends over}
 \end{array}$$

In working out a pattern with several colors, it is well to make a memorandum of the number of ends required of each color in one pattern, as it proves convenient in getting out the total number of ends of each color, and at the same time helps to avoid errors. So we will make our memorandum as follows, which is the number of ends required in one pattern of each color:

$$\begin{array}{r}
 14 \text{ ends of blue} \\
 12 \text{ ends of white} \\
 8 \text{ ends of red} \\
 4 \text{ ends of black} \\
 \hline
 38
 \end{array}$$

This, you see, adds up 38, which shows that it balances with the 38 ends called for in the pattern (see page 20).

Referring back to our example on page 20 where we divided the 1400 by 38, we find we have 36 complete patterns, so to find the amount of each color required we proceed as before.

In our memorandum we find we have 14 ends of blue to the pattern, so we multiply the 36 by 14 to find the total number of ends of blue required, etc.:

$$\begin{array}{r} 36 \\ 14 \text{ blue} \\ \hline 144 \\ 36 \\ \hline 504 \text{ total ends of blue} \end{array}$$

$$\begin{array}{r} 36 \\ 12 \text{ white} \\ \hline 72 \\ 36 \\ \hline 432 \text{ total ends of white} \end{array}$$

$\begin{array}{r} 36 \\ 8 \text{ red} \\ \hline 288 \text{ total ends of red} \end{array}$	$\begin{array}{r} 36 \\ 4 \text{ black} \\ \hline 144 \text{ total ends of black} \end{array}$
--	--

Now we add all our totals together, as follows:

$$\begin{array}{r} 504 \text{ blue} \\ 432 \text{ white} \\ 288 \text{ red} \\ 144 \text{ black} \\ \hline 1368 \end{array}$$

Now we have only 1368 ends accounted for out of the 1400, which we are supposed to have. By adding the 32 ends we have over, as shown in our example, we find it totals up 1400, as follows:

$$\begin{array}{r} 1368 \\ 32 \\ \hline 1400 \\ (21) \end{array}$$

Here the question comes up again, what should we do with the 32 ends? Now get this fixed in your mind thoroughly, that the 36 complete patterns are all *included in the 1368 ends*, and the 32 ends we have over is simply that many more ends belonging to our warp and is that much on to the 37th pattern. So by referring back to our pattern on page 20, counting on down from the first of the pattern to the point indicated at 2 of red, you will see that it takes up the 32 ends which we have over, and by counting from this point back to the top, and making notes of the number of ends of each color, you will find out where to add the 32 ends, as follows: Starting at the 2 of red, as marked, we have—

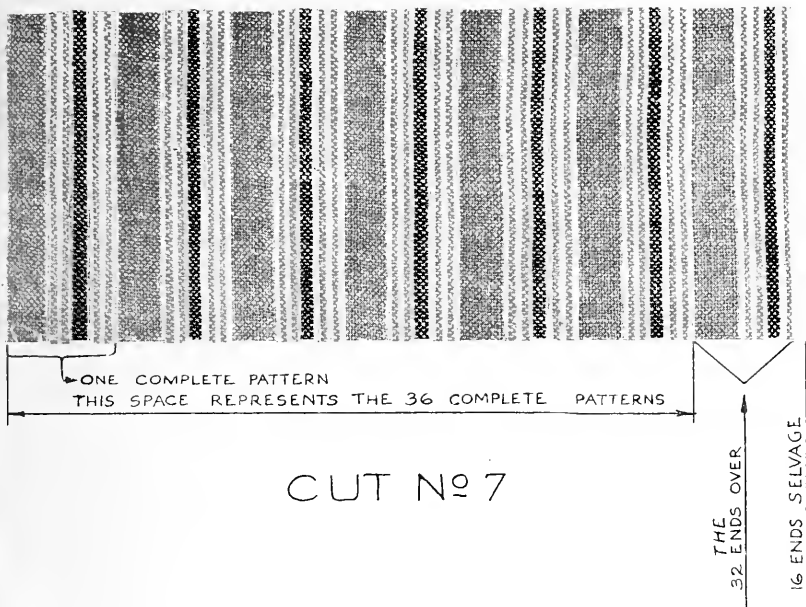
6 ends of red
8 ends of white
4 ends of black
14 ends of blue
<hr/>
32

Now going back to page 21, where we got out our total number of ends of each color, we find, by adding the above to it, we have the following:

14 added to 504 gives us 518 ends of blue
8 added to 432 gives us 440 ends of white
6 added to 288 gives us 294 ends of red
4 added to 144 gives us 148 ends of black

With the pattern arranged, as we now have it on page 20, our cloth would show up on both sides like Cut Number 7 below.

16 ENDS SELVAGE



The above cut would pass, of course, but it would not be arranged to best advantage. Therefore it should be arranged as follows, and then both sides of the cloth would show up like Cut Number 8:

Start with 8	14 blue
End with 8	2 white
	2 red
	2 white
	2 red
	2 white
	4 black
	2 white
	2 red
	2 white
	2 red
	2 white
	38

Now by referring back to our pattern on page 20, you will find we only lack the last 6 ends of the pattern of

having enough to complete the last pattern (or, in other words, the 37th pattern), as we had 36 complete patterns and 32 ends over. But, in order to arrange this pattern to best advantage, we will take 8 of the 32 ends we propose to use for selvage, and use these 8 ends towards completing our last or 37th pattern.

By referring again to the pattern on page 20 you will note below the point indicated, that we require 4 ends of white and 2 ends of red to complete the 37th pattern. So here, we use 6 of the 8 ends we have taken off of the selvage, and we have 2 ends left over, which we will use on the blue, and our pattern will be as follows:

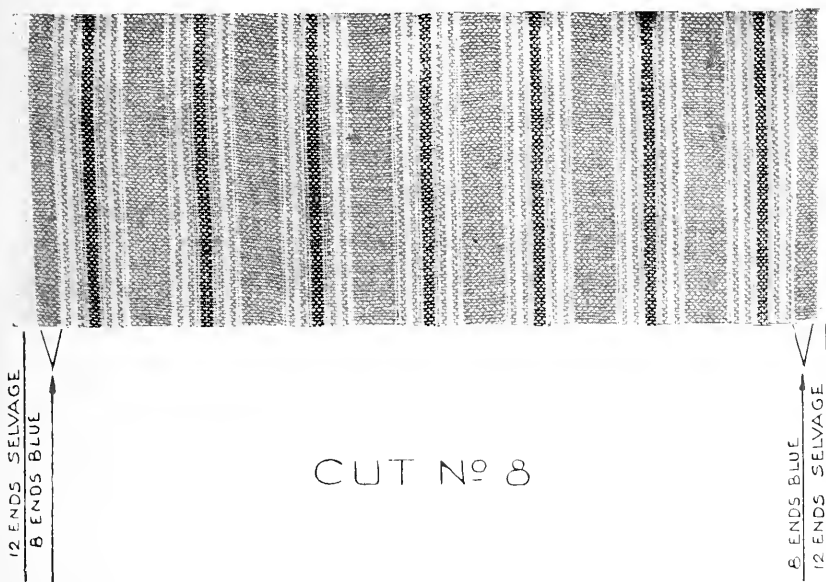
14 blue	}	37 complete patterns in the width of the cloth and the 2 ends of blue over as shown at bottom.
2 white		
2 red		
2 white		
2 red		
2 white		
4 black		
2 white		
2 red		
2 white		
2 red		
2 white		

2 blue over

Now you must understand that the 14 ends of blue at the top of pattern would come first, and would be next to selvage on one side of the cloth, with the 2 ends of blue at the bottom of pattern coming last, when laying in the warp, and would be next to selvage on the other side. So we would have 14 of blue on one side of the cloth and 2 on the other. By adding the 14 ends and 2 ends together we have 16 ends, so we will use only 8 ends of blue in the first pattern, and we will have the other 8 to go on the other side, making the cloth look alike on both sides, as shown in Cut Number 8, and our pattern should be as follows:

Start with 8	14 blue	Total Ends
End with 8	2 white	520 blue
	2 red	468 white, selvage included
	2 white	296 red
	2 red	148 black
	2 white	—
	4 blue	1432
	2 white	
	2 red	
	2 white	
	2 red	
	2 white	
	<u>38</u>	

37 complete patterns. 12 ends selvage on both sides.



Take the pattern we have just worked out, and work it out for a warp of 1600 ends instead of 1400 besides the selvage, and you will find we get about the same results, but arrive at it in a little different manner:

	14 blue
	2 white
	2 red
	2 white
	2 red
	2 white
	4 blue
	2 white
	2 red
	2 white
	2 red
	2 white
..	<hr/>
	38

Now in using a warp of 1600 ends, we of course divide the 1600 by 38 to find out how many complete patterns we have:

38) 1600 (42 complete patterns
152
<hr/>
80
76
<hr/>
4 ends over

Now the fellow who does not know exactly how these 4 extra ends should be worked in on a pattern, would say in this case—well, just add that on to the selvage—and of course would make no mark on his pattern indicating how it should commence or end up when laying in the warp; consequently the cloth would show up on both sides just about like Cut Number 7, except it would have 2 ends more of white and 2 more of red coming next to selvage on one side, and the last 2 of white would also be thrown into the selvage, and he would have 16 of white for selvage on one side and 22 on the other, which would not show up well in the finished piece of goods.

The right way to handle this pattern, however, would be as follows: Add the *4 ends over* onto the blue, and as you understand, these 4 ends of blue would come on the side of the warp you finish up on when laying it in. So you would have the first 14 ends of blue as called for in the pattern on the side you commence on and the 4 ends

over on the other side. Now we will just say we will take 4 ends out of the first pattern where we commence and place them over on the other side with the other 4 ends and make our cloth show up with 10 of blue in first pattern next to selvage instead of 14, and 8 ends on the other side coming next to the selvage, and the pattern should be written as follows:

Start with 10	14 blue
End with 8 /	2 white
	2 red
	2 white
	2 red
	2 white
	4 black
	2 white
	2 red
	2 white
	2 red
	2 white
	<hr/>
	38

42 complete patterns. 16 ends selvage on both sides.

Now we will work out the total ends as before, as follows:

42
14 blue ends to pattern
<hr/>
168
42
<hr/>
588

Here we have 588 ends of blue in the 42 patterns, and as we are to add the 4 ends we have over on the blue our total ends will be as follows:

	42		42		42
	12 white		8 red		4 black
	<hr/>		<hr/>		<hr/>
	84		336		168
	42				
	<hr/>				
	504		Total Ends		
Selvage	32 ends		592 blue		
	<hr/>		536 white, selvage included		
	536		336 red		
			168 black		
			<hr/>		
			1632		

With this pattern arranged, as shown on page 27, the cloth would show up the same as in Cut Number 8, except there would be 10 ends of blue on first side instead of 8.

CHAPTER SIX

In this chapter we will take up a pattern having some *corded work*, which you will note brings about a slight change in the way we find the number of patterns contained in the warp. We will take the following pattern:

	16	blue	
	4	white	
	16	blue	
	2	white	
	2	black	
cord	4	white	one eye (one dent)
	2	black	
	2	white	
	4	red	
	2	white	
	2	black	
cord	4	white	one eye (one dent)
	2	black	
	2	white	
	<hr/>		
	64		
	4	less extra ends used to each pattern	
	<hr/>		
	60		

Now it must be understood that all the patterns we have been working out, up to this one, have been in the *plain construction* of 2 ends to each dent in the reed, and in working out any pattern that is *irregular* in the reed, such as cords, or extra doublings, it must be figured on the same basis as though there were 2 ends to each dent, in order to keep the same *width of warp in the reed*; therefore, in this case, as the 2 cords in each pattern use 4 ends to the dent, we have 4 extra ends to the pattern (2 extra ends at each cord), so we subtract the 4 extra ends from the total ends in the pattern, which leaves 60 (as above); and this is the figure we must use to divide the total number of ends in the warp by to find out the required number of patterns. Counting 1400 ends to the warp, we have the following:

60)1400 (23 complete patterns

120

200

180

20 ends over

Now the way this pattern comes out leaves our selvage in rather bad shape. So we will have to do some changing around to get both sides to look alike. You will understand, of course, that the 20 ends over are that many ends on towards the 24th pattern; that being the case, of course, we will start back at the top of the pattern to add on and we find our pattern first calls for 16 of blue, and next 4 of white, so we would add 16 ends on to the blue and 4 on to the white, which takes up the 20 ends we have over the 23 patterns. Now if we should add these ends on this pattern, as just suggested, our pattern should be written as follows, and the selvage would show up like Cut Number 9, page 32:

	16 blue	Total Ends
End	4 white	752 blue
	16 blue	280 white
	2 white	184 black
	2 black	92 red
cord	4 white one eye (one dent)	184 white for cord
	2 black	1492
	2 white	32 white for selvage.
	4 red	1524
	2 white	
	2 black	
cord	4 white one eye (one dent)	
	2 black	
	2 white	
	64	
	23 complete patterns	16 ends selvage on first side
		20 ends selvage on other side

NOTE—The last four ends of white where the pattern ends come next to selvage on last side, making 20 ends of white for selvage on that side.

We will first get out our memorandum of colors for each pattern, as follows:

32 ends of blue
 12 ends of white
 8 ends of black
 4 ends of red
 8 ends of white for cord

64

Referring back to page 30, we find we have 23 complete patterns, so we find the number of ends required of each color as follows:

32 blue	12 white	8 black	4 red	8 white for cord
<u>23</u>	<u>23</u>	<u>23</u>	<u>23</u>	<u>23</u>
96	36	184	92	184
<u>64</u>	<u>24</u>			
736	276			

Total Ends

736 blue

276 white

184 black

92 red

184 white for cord

20 ends over to add (See Page 30)

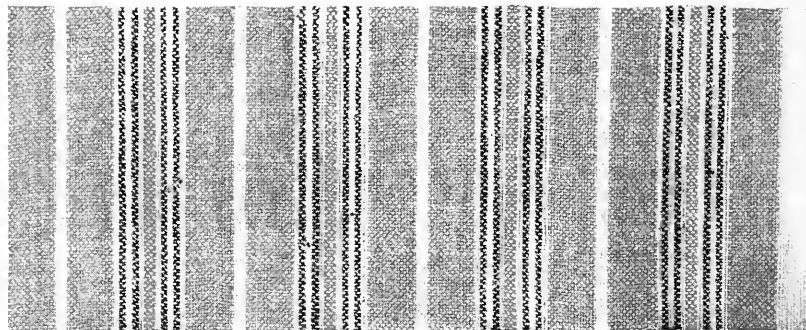
1492

Here we find we have 1492 ends, when we are supposed to have only 1400; but you will note that we have 4 extra ends to the pattern in this warp (see page 29) on account of the corded work, and as we have 23 complete patterns we will multiply the 23 by 4 and we find we have 92 extra ends in the warp on account of the cords.

Now, if we deduct the 92 ends from the 1492, it leaves 1400, and as 1400 ends is the number of ends our pattern is based on, it proves that our example is correct.

On page 30 we show that there are 16 ends of the 20 to be added onto the 736 of blue and 4 onto the 276 of white besides the 32 ends for selvage, which makes our total number of ends as shown on page 30.

16 ENDS SELVAGE



ONE COMPLETE PATTERN

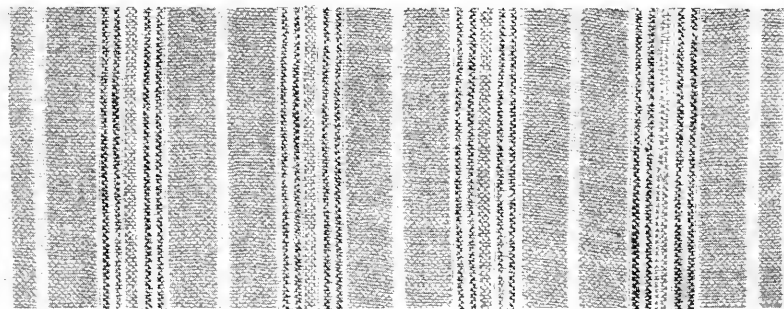
THIS SPACE REPRESENTS THE 23 COMPLETE PATTERNS

CUT №9

THE 20 ENDS OVER

16 ENDS SELVAGE

16 ENDS SELVAGE
8 ENDS BLUE



CUT №10

8 ENDS BLUE
16 ENDS SELVAGE

This pattern as arranged on page 30, which would show up on the selvages as in Cut Number 9, is *not* correct, but should be arranged as follows and would then show up as in Cut Number 10, which is *correct*:

Start with 8	16 blue	
End with 8	4 white	
	16 blue	
	2 white	
	2 black	
cord	4 white	one eye (one dent)
	2 black	
	2 white	
	4 red	
	2 white	
	2 black	
cord	4 white	one eye (one dent)
	2 black	
	2 white	
	64	

Now you will notice that in having the pattern arranged as above we lay only 8 ends of blue for the first stripe instead of 16, as called for on page 30, and the 8 ends we have left out here to start with we carry on over to the other side, and when we finish up we find we have 8 ends of blue towards the second 16 of blue called for, which makes our pattern end up as marked above, and the cloth would show up as in Cut Number 10, which, I am sure, you will agree is an improvement over the selvages in Cut Number 9. In this case, however, the number of ends of each color would be the same as shown on page 30.

CHAPTER SEVEN

In this chapter we will have still another example in corded work, which, together with the one we have just explained, should enable anyone to handle anything along this line, as the general principles in working out all such patterns are included in these two. As you will understand, the number of *heddles* required to weave a piece of goods has nothing to do with the number of *ends* required in the warp. The number of heddles required for producing a piece of goods depends entirely on the kind of weave called for, etc. This part of the work, however, would of course come under the head of designing, while the object of this book is to teach you how to figure out the patterns whether you understand anything about designing or not.

	12 black	
x—	4 red	one end each eye
x—	4 red	one end each eye
	12 black	
	2 white	
	4 blue	
x—	2 white	one eye
	4 blue	
	2 white	
	4 blue	
x—	3 white	one eye
	4 blue	
	2 white	
	4 blue	
x—	4 white	one eye
End with 3	4 blue	
	2 white	
	4 blue	
x—	3 white	one eye
	4 blue	
	2 white	
	4 blue	
x—	2 white	one eye
	4 blue	
	2 white	
	—	
	98	
	8 extra ends in each pattern	
	—	
	90	

NOTE—All places marked “x” mean, reeded in one dent.

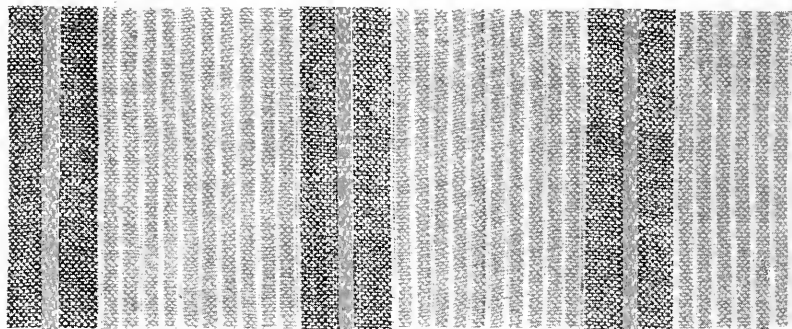
In working out this pattern, as shown on page 34, we will suppose our warp is to have 1600 ends in addition to the 32 ends for selvage.

We find the total number of ends in this pattern is 98. We also find that we have 8 extra ends used in the pattern on account of doublings in the reed, and as we are to work out the pattern on a basis of only 2 ends to each dent in the reed, in order to maintain a given width in the reed, regardless of the doublings in the reed, we simply subtract the 8 extra ends from the 98 in the pattern and use the 90 to work out our pattern by, as follows:

$$\begin{array}{r}
 90)1600(17 \text{ complete patterns in the warp} \\
 \underline{90} \\
 700 \\
 \underline{630} \\
 70 \text{ ends over}
 \end{array}$$

Here we find we have 17 complete patterns and 70 ends on towards the 18th pattern, so we begin at the top of our pattern now and count the ends on down until we count 70, and we will find where the 18th pattern would end. Well, now we find it ends with 3 ends of blue at the point indicated (page 34). Now if we should let this pattern go at that, the selvages of the cloth when woven would show up like Cut Number 11.

16 ENDS SELVAGE



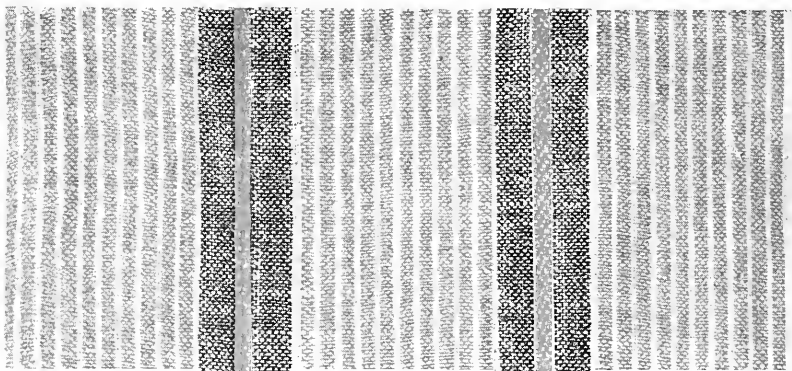
ONE COMPLETE PATTERN
THIS SPACE REPRESENTS THE 17 COMPLETE PATTERNS

CUT N° 11

THE 70 ENDS OVER

16 ENDS SELVAGE

20 ENDS SELVAGE



CUT N° 12

20 ENDS SELVAGE

In this pattern you will note from Cut Number 11 that the selvages show up quite different, while in Cut Number 12 both selvages are exactly alike; therefore, we will mark off the pattern showing the starting and stopping points as shown in Cut Number 12, which is correct, and should be written as follows:

	12 black	
	x— 4 red	one end each eye
	x— 4 red	one end each eye
	12 black	
	2 white	
<u>Start here</u>	4 blue	
	x— 2 white	one eye
	4 blue	
	2 white	
	4 blue	
	x— 3 white	one eye
	4 blue	
	2 white	
	4 blue	
	x— 4 white	one eye
	4 blue	
	2 white	
	4 blue	
	x— 3 white	one eye
	4 blue	
	2 white	
	4 blue	
	x— 2 white	one eye
<u>End here</u>	4 blue	
	2 white	
	<hr/>	
	98	

Now in writing this pattern off for the slasher man or the beamer hand, as the case might be, as shown above, instead of commencing to lay in the warp at 12 black—the first of the pattern—he would commence on the *first* 4 of blue as indicated, and when he finished up his last pattern would end on the *last* 4 of blue as indicated.

Please bear in mind that when we go to write off a pattern we cannot tell how it will end up until we have worked it out up to the point where we have carried this

one, and that is the reason we sometimes have to mark our *starting point* down below the beginning of the pattern. However, when we once find out how the pattern will end up, and we get it laid off to best advantage, as we have now done in this case, we can *re-write* the pattern, as shown below, which will be exactly the same thing and possibly will be a more desirable arrangement for the slasher or beamer hand:

	-	4	blue	
	x—	2	white one eye	
		4	blue	
		2	white	
		4	blue	
	x—	3	white one eye	
		4	blue	
		2	white	
	.	4	blue	
	x—	4	white one eye	
		4	blue	
		2	white	
		4	blue	
	x—	3	white one eye	
		4	blue	
		2	white	
		4	blue	
	x—	2	white one eye	
End here	—	4	blue	
		2	white	
		12	black	
	x—	4	red one end one eye	
	x—	4	red one end one eye	
		12	black	
		2	white	
	—			
		98		
		8	extra ends in each pat-	
	—		tern for cord, etc.	
		90		

In this case the beamer or slasher man, when he would start to lay in the warp, would commence on the 4 of blue at first of pattern and his last pattern would end up as indicated.

Now we proceed to work out this pattern as follows:
Referring to pattern as written on page 38—

$$\begin{array}{r}
 90)1600 \text{ (17 complete patterns)} \\
 \underline{90} \\
 700 \\
 \underline{630} \\
 70 \text{ ends over}
 \end{array}$$

By referring to the pattern on page 38 we find, by counting down from first of pattern to point indicated where the last or 18th pattern should end, that we have only 62 ends called for, while we have 70 ends over that we are supposed to take care of. But you will note, as we have the pattern arranged, both sides are exactly alike; so in this case we will just add the other 8 ends onto the selvage, making the pattern read 20 white on each side, and the total number of ends would be as follows. First we will see how many ends of each color is called for to a pattern; starting at the top of pattern and picking out the blue first, we find:

$$\begin{array}{r}
 40 \text{ ends of blue} \\
 14 \text{ ends of white (cord work)} \\
 12 \text{ ends of white (plain)} \\
 24 \text{ ends of black} \\
 8 \text{ ends of red} \\
 \hline
 98
 \end{array}$$

We find this adds up 98, which agrees with the total ends in pattern and proves it is correct. Now by referring to the above we find we have 17 complete patterns in our warp; so we find the total number of ends of each color, just as we have done in all the preceding patterns, as follows:

40 blue	14 white (cord)	12 white (plain)	24 black	8 red
<u>17</u>	<u>17</u>	<u>17</u>	<u>17</u>	<u>17</u>
280	98	84	168	136
<u>40</u>	<u>14</u>	<u>12</u>	<u>24</u>	
680	238	204	408	

Now we total it all up as follows :

680	blue
238	white (for cord)
204	white (plain)
408	black
136	red
70	the ends we have over (see Page 39)
<hr/>	
1736	

Now we find our total number of ends amounts to 1736, when our pattern is figured out on page 39 on a basis of the warp having only 1600 ends.

1736
1600
<hr/>
136 extra ends required on account of cord, etc.

By subtracting the 1600 from 1736 we find it leaves a difference of 136. This 136 ends are extra ends required in this warp on account of the corded work—that is, the extra doublings in the reed—and in order to prove our example and see if we have the right number of ends added on account of the corded work, we simply multiply the number of complete patterns we have in the warp by the number of extra ends we have to each pattern, and if it agrees with the extra ends called for, as shown above, it proves our example is correct, thus :

In this warp we have 17 complete patterns, and we have 8 extra ends to each pattern on account of corded work and extra doublings in the reed ; so our example would be as follows :

$$\begin{array}{r} 17 \\ 8 \\ \hline 136 \end{array}$$

Here we find 17 multiplied by 8 gives us 136, which proves our work to be correct.

Now in order to add the 70 ends we have over (on page 39) and get the right number of ends on each color,

we will begin at the top of the pattern (as shown on page 38) and count down to point indicated where the last pattern should end; taking the blue first, we have:

40 ends of blue	
14 ends of white (cord work)	
8 ends of white (plain)	
<hr/>	
62	
8 the ends we propose to add	
<hr/>	
70	on selvage

Here we have taken care of the 70 ends we have over, as shown in our example on page 39; so now, in order to get the *total* number of ends of each color, we add the ends as shown above to the amount called for on page 39, and we have:

40 ends added to 680 totals	720 ends of blue
14 ends added to 238 totals	252 ends of white (for cord)
8 ends added to 204 totals	212 ends of white (plain)
<hr/>	408 ends of black
62	136 ends of red
	8
8 ends added to selvage	
<hr/>	<hr/>
70	1736

Here we have a total of 1736 ends, which agrees with our total number of ends as shown on page 40—this being another check on our work showing it is correct (as the 32 ends for selvage are not included in the above). Now when this pattern goes to the beamer or slasher man it should be written out as follows:

	4 blue	
x—	2 white one eye	
	4 blue	
	2 white	
	4 blue	
x—	3 white one eye	
	4 blue	
	2 white	
	4 blue	
x—	4 white one eye	TOTAL ENDS
	4 blue	720 blue
	2 white	252 white (corded work)
	4 blue	252 white (plain) selvage incld.
x—	3 white one eye	408 black
	4 blue	136 red
	2 white	
	4 blue	<hr/> 1768
	x— 2 white one eye	
<u>End here</u>	4 blue	
	2 white	
	12 black	
x—	4 red	one end one eye
x—	4 red	one end one eye
	12 black	
	2 white	
	<hr/> 98	

17 complete patterns. Selvage 20 ends on each side.

CHAPTER EIGHT

All that has been written so far in this book regarding the importance of having both selvages of the cloth look as near alike as possible, has reference to all kinds of fancy and staple gingham, dress goods, plaids, domets, etc.; but when it comes to bed-ticking, counterpanes, carpets, etc., it is equally as important that we have both selvages so arranged that when the goods are sewed together along the selvages, a complete pattern will be formed, and in order to illustrate this we will take the following pattern in ticking:

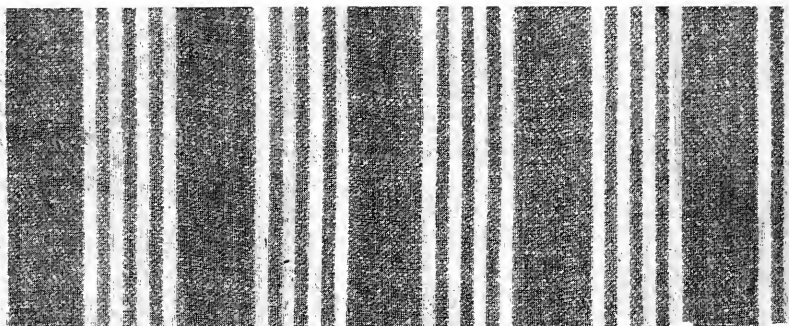
	36 blue
	6 white
	6 blue
<u>End here with 2—</u>	6 white
	6 blue
	6 white
	6 blue
	6 white
	<hr style="width: 10%; margin: 0;"/>
	78

We will suppose this warp is to have 2000 ends, in addition to the selvage, and we will have 40 ends for selvage—20 on each side. So we will work out the pattern in the usual way, as follows:

$$\begin{array}{r}
 78)2000 \text{ (25 complete patterns)} \\
 \underline{156} \\
 440 \\
 \underline{390} \\
 50 \text{ ends over}
 \end{array}$$

Now we find we will have 25 complete patterns in the entire width of the cloth and 50 ends towards the 26th pattern, which would cause the pattern to end up at point indicated, and the cloth would show up on the selvage as shown in Cut Number 13.

20 ENDS SELVAGE



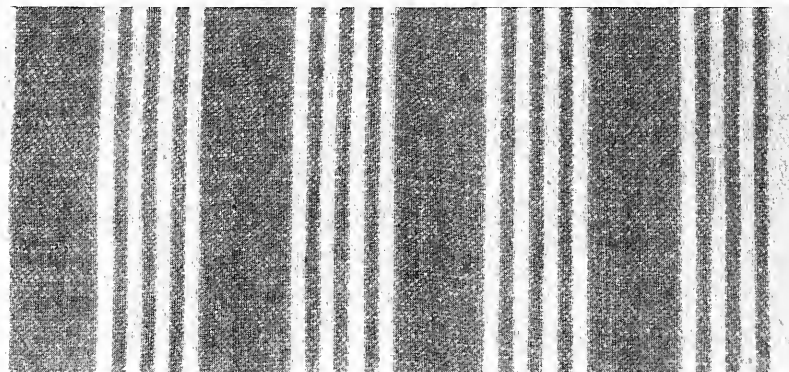
ONE COMPLETE PATTERN
THIS SPACE REPRESENTS THE 25 COMPLETE PATTERNS

CUT N° 13

THE 50 ENDS OVER

20 ENDS SELVAGE

20 ENDS SELVAGE



THIS SPACE REPRESENTS THE 25 COMPLETE PATTERNS

CUT N° 14

20 ENDS SELVAGE

You will note if this pattern should finish up like Cut Number 13, when the two selvages are sewed together you would have a badly disfigured pattern at the seam, as you would have only one small stripe of blue and white separating two of the broad stripes of blue; therefore it will be necessary to make a slight change in the pattern in order to make the pattern work out nearer even. In this case this pattern should be written as follows:

	38 blue
	6 white
	6 blue
	6 white
	6 blue
	6 white
	6 blue
End here	6 white
	<hr/> 80
80) 2000	(25 complete patterns
	160
	<hr/> 400
	400
	<hr/> nothing over

By writing the pattern, as above, we simply use 38 of blue in the pattern instead of 36, which is a very slight change and does not change the appearance of the pattern in the cloth enough to be noticed, and at the same time it gives us 80 ends to each pattern instead of 78, which makes our warp divide up into even patterns and our cloth would show up like Cut Number 14, which is correct for this kind of goods. However, both selvages of this pattern could be made to look exactly alike by taking half of the 38 of blue in first pattern and placing it on the other side, and when the cloth is sewed together the results would be the same and the pattern would be written as follows:

<u>Start with 18</u>	38 blue	Total Ends
<u>End with 20</u> /	6 white	1400 blue
	6 blue	600 white
	6 white	<u>2000</u>
	6 blue	40 ends for selvage
	6 white	<u>2040</u>
	6 blue	
	6 white	
	<u>80</u>	

25 complete patterns, even. Selvage, 20 ends on both sides.

The above pattern would be worked out as follows :

56 ends of blue to one pattern
24 ends of white to one pattern
<u>80</u>

Referring to page 45 we find we have 25 complete patterns with no ends over ; therefore, we have nothing to add on.

56 blue	24 white
<u>25</u>	<u>25</u>
280	120
<u>112</u>	<u>48</u>
1400	600

CHAPTER NINE

In working out a pattern that has corded work of a ply yarn, where you have only one thread of the ply yarn to a dent in the reed, when we are working on a basis of 2 ends to each dent, it should be worked as follows, taking the following pattern:

<u>End here</u>	14 black
one dent	1 cord (ply yarn)
	4 black
one dent	1 cord (ply yarn)
	<hr style="width: 10%; margin: 0;"/>
	20
	2
	<hr style="width: 10%; margin: 0;"/>
	22

Here we have 2 cords in the pattern using only one end to the dent. So in cases of this kind we *add* just as many ends to the total ends in the pattern as there are ends left out in the reed on account of the cord, which in this case is 2 ends to the pattern (this you will note works just the reverse when using cords composed of single yarn); therefore we *add* 2 to the 20 and use the figure 22 to divide by to find the correct number of patterns in the warp. Suppose we are working on a basis of 1400 ends to the warp, we would have the following example:

$$\begin{array}{r}
 22) 1400 \text{ (63 complete patterns)} \\
 \underline{132} \\
 80 \\
 \underline{66} \\
 14 \text{ ends over}
 \end{array}$$

Black 18 ends to the pattern	Cord 2 ends to the pattern
63 patterns	63
<hr/> 54	<hr/> 126 total ends
108	
<hr/> 1134	
14 the 14 ends over	
<hr/> 1148 ends black required	

Here we have added the 14 ends over on to the black, which would make the pattern read as follows, and the cloth would be exactly alike on both sides:

End here	14 black	Total Ends
one dent	1 cord (ply yarn)	1148 black
	4 black	126 cord (ply yarn)
one dent	1 cord (ply yarn)	<hr/> total 1274
	<hr/> 20	126 equals 2 multiplied
	2	<hr/> by 63
	<hr/> 22	1400

63 complete patterns. Selvage 16 on both sides.

Here, you will note, our total number of ends *required* is only 1274, while we were working the pattern on a basis of 1400 ends; you will note also that by multiplying the 2 ends we added to each pattern by 63—the number of complete patterns—we get 126. This amount, added to the 1274, totals 1400, which proves our example correct.

CHAPTER TEN

BLANKET SHEETS

Quite often it becomes necessary to get out a lot of samples of pattern work, especially so with the mills that make more or less of gingham, dress goods, etc.; and it is most always customary to get them out in what is called "blanket sheets." While this is rather expensive and lots of trouble, yet it enables the mills to get out quite a variety of samples in a comparatively short time, without having much yarn and goods tied up in a lot of new styles before they know what styles will be most acceptable to the trade.

In making blanket sheets it is simply a matter of making 2 or more different styles of patterns, side by side in the reed, all beamed on the same beam, and is simply a piece of cloth made up of different patterns, the full width of the piece being equally divided, according to the number of different patterns being made.

If your pattern happens to be small and medium-sized checks, it is usually the practice to make *each pattern* about 7 inches wide in the reed; therefore you can easily make 4 such patterns at a time, giving each pattern a space of 7 inches in the reed, making your warp spread 28 inches in the reed. If you should happen to have very large checks or stripes, it would possibly be necessary to make each pattern about $9\frac{1}{3}$ inches wide in the reed. This being the case, you would be able to weave only 3 patterns at a time, in a reed space of 28 inches.

Before deciding on the width of your blanket sheets, however, it is well to *first* find out what *widths* can be handled *successfully* in the *finishing* process. Don't under any circumstances, make your blanket sheets any wider than can be handled satisfactorily in the finishing plant. I have seen good nice samples ruined simply by

making them wider than the regular run of cloth in the finishing machines, making it necessary to readjust the guides, etc., on every machine, and before the few yards of samples get through, more or less of it is damaged all on account of making the goods a little too wide, in order to save a little time in the weaving.

We will suppose for an illustration that we want to make the following 4 patterns into a blanket sheet form for samples, and we want each pattern to cover a space of 7 inches in the reed, making the total width in the reed 28 inches besides the selvage. We will suppose we are going to use a 27-dent reed—that is, 27 dents in the reed to the inch—and we will draw our warp in the reed 2 ends to each dent.

First we must find out how many *ends* our entire width of blanket will contain—that is, all *four* of the patterns. We have a 27-dent reed and we propose to spread our warp 28 inches, using 2 ends to each dent; therefore we have the following, using 27 dents to the inch and 2 ends to each dent:

$$\begin{array}{r} 27 \\ 2 \\ \hline 54 \text{ ends per inch in reed} \end{array}$$

Here we have 54 ends to each inch of reed space we propose to use, and as we are to have a total width of 28 inches in the reed we have 54 times 28, as follows, for the total number of ends:

$$\begin{array}{r} 54 \\ 28 \\ \hline 432 \\ 108 \\ \hline 1512 \text{ total ends required besides selvage} \end{array}$$

Now, as we are to have 4 different patterns in the width of this cloth, we divide the 1512—total ends required for total width—by 4, thus:

4)1512(378 total ends required for *each* pattern

12
 —
 31
 28
 —
 32
 32

In working out the total number of ends required for the blanket we must work out each different pattern separately, using the 378 ends required for each. We will take the following 4 patterns:

No. 1	No. 2	No. 3	No. 4
End 6 blue 6 white — 12	End 4 10 blue 4 white 4 blue 4 white — 22	16 blue 2 white 4 blue 2 white End 4 16 blue 2 white 2 blue 2 white 2 blue 2 white — 50	8 blue 8 white 4 blue 8 white 8 blue 4 white 4 blue 4 white 4 blue 8 white 4 blue 4 white 4 blue End 2 4 white — 76
31 patterns Total ends 378	17 patterns Total ends 378	7 patterns Total ends 378	4 patterns Total ends 378

REED	7 inches ← 31 patterns →	7 inches ← 17 patterns →	7 inches ← 7 patterns →	7 inches ← 4 patterns →	REED
------	-----------------------------	-----------------------------	----------------------------	----------------------------	------

← The 28 inches reed space used →

Here we find, by dividing the 378 by 12—the total ends in pattern No. 1—we have:

No. 1	No. 2
12) 378 (31 complete patterns 36 — 18 12 — 6 ends over	22) 378 (17 complete patterns 22 — 158 154 — 4 ends over

No. 3	No. 4
50)378(7 complete patterns	76)378(4 complete patterns
350	304
<hr/> 28 ends over	<hr/> 74 ends over

Now we find the total number of ends of *each color* required for *each different pattern*.

Number 1—We find we call for 6 ends of blue and 6 ends of white to the pattern, so we refer to Number 1, on preceding page, and we find we have 31 complete patterns and 6 ends over. So we multiply the 31 by 6 to find the ends of blue required:

31	31
6	6
<hr/> 186 blue required	<hr/> 186 white required

The 6 ends we have over we add on to the blue, making the total ends required for Number 1 as follows:

192 blue
186 white
<hr/> 378

Number 2 calls for 14 ends of blue to the pattern and 8 ends of white, and as we have 17 complete patterns in Number 2 and 4 ends over we multiply the 17 by 14:

17	17
14	8
<hr/> 68	<hr/> 136 white required
17	
<hr/> 238 blue required	

The 4 ends we have over we add on the blue, making total ends for Number 2 as follows:

242 blue
136 white
<hr/> 378

Number 3 calls for 40 ends of blue and 10 ends of white for each pattern, and as we have 7 complete patterns in Number 3 we multiply the 40 by 7:

$$\begin{array}{r} 40 \\ 7 \\ \hline 280 \text{ blue required} \end{array}$$

$$\begin{array}{r} 10 \\ 7 \\ \hline 70 \text{ white required} \end{array}$$

In this pattern we have 28 ends over, so we count down from the top of the pattern until we count 28 and we find it ends on the second 16 of blue with only 4 ends, so we start at point indicated commencing with the 4 and count back to the top, and we find we require 24 ends for the blue and 4 for the white, which takes care of the 28 ends we have to add on. So we add 24 on to the blue and 4 on to the white, making total ends of each color for this pattern as follows:

$$\begin{array}{r} 280 \\ 24 \\ \hline 304 \text{ blue} \end{array}$$

$$\begin{array}{r} 70 \\ 4 \\ \hline 74 \text{ white} \end{array}$$

$$\begin{array}{r} \text{Total ends required} \\ 304 \text{ blue} \\ 74 \text{ white} \\ \hline 378 \end{array}$$

Number 4—We find we require 36 of blue and 40 of white to each pattern, and as we have only 4 complete patterns in Number 4, we multiply the 36 by 4 to find the blue required, and 40 by 4 to find the white required.

$$\begin{array}{r} 36 \\ 4 \\ \hline 144 \text{ blue} \end{array}$$

$$\begin{array}{r} 40 \\ 4 \\ \hline 160 \text{ white} \end{array}$$

In this pattern we have 74 ends over, and by counting down from the top to the point indicated we find our last pattern ends with 2 ends at the last 4 of white. So by counting down from top of pattern to point indicated, we find we require 36 of blue and 38 of white, which we

add on to each color, making the total ends required for each color in this pattern as follows:

144	160
<u>36</u>	<u>38</u>
180 blue required	198 white required
	180 blue
	<u>198 white</u>
	378

Now we add all the blue called for in each of the four patterns and all the white, and we find the total ends of each color required for the blanket as follows:

No. 1—Blue	192	white	186
No. 2—Blue	242	white	136
No. 3—Blue	304	white	74
No. 4—Blue	180	white	198
	<u>918</u>		<u>594</u>
Total blue.....	918	white	594

Here we find we have total ends required—

918 blue
<u>594 white</u>
1512

Our total ends required, you see, agrees with the total ends we started out to work the blanket from on page 50, which proves our examples all correct.

This covers the principles involved in working out any blanket sheets, and this, together with the other information contained in this book, should enable anyone to work out any kind of pattern proposition that is liable to come up.

CHAPTER ELEVEN

NOTE—We have used the decimal method of expressing all fractions in these examples, for the reason that they are so much more easily understood and easier to handle in calculations. For example: .1 equals $1/10$ (one tenth); .6 equals $6/10$ (six tenths); .07 equals $7/100$ (seven hundredths); .24 equals $24/100$ (twenty-four hundredths) .073 equals $73/1000$ (seventy-three thousandths); .814 equals $814/1000$ (eight hundred and fourteen thousandths), etc. In other words, where there is only one figure to the right of the decimal point, it expresses tenths; two figures to the right of the decimal point expresses hundredths; three figures to the right of the decimal point expresses thousandths, etc.

While the principal object of this book is to teach those desirous of learning, how to figure out all kinds of pattern work—what is generally termed “figuring out patterns” for gingham, fancy dress goods, plaids, ticking, etc.,—it will be interesting to some, no doubt, to know how to find the width of a piece of goods, number of ends required to weave it, and about what the goods will weigh—that is, the number of yards per pound. So I will give a few simple rules which will enable anyone with a very slight knowledge of mathematics to understand.

In the first place it is well to bear in mind that there is no rule that will always work out exact in cases of this kind, as it is next to impossible to hit just right on a few things that have to be estimated in figuring the *width* and *weight* of the cloth—such as the exact take-up, the exact percentage of size on the warp, etc.—and in making such calculations it is necessary to use reasonable judgment in allowing for the take-up in weaving in *width* and *length*; also in the amount of size on the warp, keeping in mind the fact that *there is no sizing on the filling*.

TO FIND THE PERCENTAGE OF SIZING ON A WARP

Take one average warp, weigh it before it is sized and then weigh the *same warp* after it is sized and you will get a fair average. Thus, if the warp weighs 100 pounds before it is sized and the same warp weighs 107 pounds afterwards, you have:

$$\begin{array}{r}
 107 \text{ weight after being sized} \\
 100 \text{ weight before being sized} \\
 \hline
 7 \\
 100 \\
 \hline
 \text{Weight of warp before} \quad \text{100} \\
 \text{being sized} \text{-----} > \text{100} \quad 700 \text{ (7 per cent size on warp)} \\
 \text{700}
 \end{array}$$

TO FIND HOW MUCH THE CLOTH WILL TAKE UP IN WIDTH

If convenient go to a loom weaving on a similar piece of goods and see how wide it is *in the reed* and then measure it down on the *cloth roller*. First see that the warp has about the right tension, as you can very easily vary the width of the cloth one-half inch or more by tightening or loosening up on the beam weights.

On ordinary gingham, etc., with about 28-inch reed space, the goods will come off the loom about 26½ to 27 inches wide. If the goods should be of a rather open construction it will pull down to as low as 26 inches, while if it is closely woven it will average about 27 inches. On wider goods, the difference, of course, will be in proportion to the width.

TO FIND THE TAKE-UP IN LENGTH

This will vary according to the picks per inch being put in, also according to the number of yarn of the filling used and the number of warp yarn and the nature of the weave—that is, whether it is a plain weave or a three or four harness twill, etc.—so it is a good idea to get a similar piece of cloth just like it comes off the loom (that is, before it is finished), cut off 10 inches in length, *warp way*, pull out a few warp ends, straighten them out good and see how much longer the warp threads are than the

piece of cloth; if the cloth is 10 inches long and the warp ends measure out $10\frac{1}{2}$ inches long, you have a 5 per cent. take-up, thus:

	10.5 warp ends
Subtractor	10.0 cloth
	<hr style="width: 10%; margin: 0;"/>
	.5
	100
	<hr style="width: 10%; margin: 0;"/>
Divisor	100)500 (5 per cent take-up
	500
	<hr style="width: 10%; margin: 0;"/>

In order to simplify this rule, we simply use the decimal point thus, 10.5, which is the same as $10\frac{1}{2}$.

RULE: In finding the percentage of take-up by this rule subtract the length in *inches of the cloth* from the length of the *warp ends in inches*, multiply this difference by 100 and then divide by length of cloth in inches, using same *number of figures* for divisor as *are used* in subtracting.

TO FIND NUMBER OF ENDS REQUIRED FOR GIVEN WIDTH

Suppose you wanted to weave a piece of goods 28 inches wide in the reed and you were going to use a 29-dent reed (that is, 29 dents to the inch) and you wanted to have 2 ends to each dent; find the number of ends required:

29 dent reed
2 ends in each dent
<hr style="width: 10%; margin: 0;"/>
58 ends in one inch
28 inches wide in reed
<hr style="width: 10%; margin: 0;"/>
464
116
<hr style="width: 10%; margin: 0;"/>
1624 ends required besides the selvage

(This cloth would come off the loom about one inch or one and a half inches less in width, according to the yarn used, picks put in, weight on loom beam, etc.)

CHAPTER TWELVE

HOW TO FIGURE THE WEIGHT OF GOODS BEFORE BEING WOVEN

On pages 56 and 57 we have explained how to find the percentage of sizing and take-up. Now when you go to work in the sizing and take-up, work it in as follows: First, supposing you have 5 per cent. sizing on your warp and the take-up amounts to 10 per cent.; *add* them both together, making it 15 per cent. size and take-up. But instead of multiplying by 15 make it 1.15, placing the decimal point before the 15 as shown.

Take the pattern as we have worked out in Chapter One, we have a total of 1432 ends:

1432 Total ends in warp
1.15 Size and take-up

1160

1432

1432

1646.80 This is the dividend for *warp only*.

NOTE—Bring down your decimal point.

Now for a *divisor for the warp only*, multiply 840 by the number of warp yarn you propose to use. We will suppose we are going to use for this warp No. 26's:

840

26 number of warp yarn

5040

-1680

21840 Divisor for *warp only*

DIVIDEND
DIVISOR →
 21840) 1646.80 (.075 weight of warp in one yard of cloth

1528.80

118.000

109.200

Now we have gotten out the weight of the warp for *one yard* of cloth, so we next get out the weight of filling for *one yard*. To determine this, however, we must know what number of filling we propose to use, the number of picks to the inch, and the width of warp in the *reed*.

REED: We will use a 26-dent reed, 2 threads to each dent, which will give us 52 threads to the inch in the reed.

PICKS: We will have 54 picks to the inch in this goods and we will use No. 24's yarn for filling.

In order to be *exact*, regarding the width in the reed, we *should deduct* just half of the number of warp ends we propose to use for selvage (as the selvage is drawn 4 ends to the dent) from total ends in warp, when figuring for the width in the reed, but as that little difference amounts to practically nothing in figuring the weight, we will take the *total* number of ends to figure from.

Now we divide the 1432 by 52, which is the number of warp ends to each inch of reed space; this, of course, will give us the width in inches in the reed. Thus:

$$\begin{array}{r}
 52 \overline{)1432} \text{ (27.54 inches wide in the reed)} \\
 \underline{104} \\
 392 \\
 \underline{364} \\
 280 \\
 \underline{260} \\
 200 \\
 \underline{208} \\
 0
 \end{array}$$

Now, as we are to have 54 picks of filling to the inch, in order to find the length of filling used to one inch of cloth we multiply the 27.54 by 54, thus:

Divid'd for filling (yards) 1487.16 inches of filling used in one inch
of cloth
or
Yards of filling used in one
yard of cloth

$$\begin{array}{r} 840 \\ 24 \text{ No. of filling yarn} \\ \hline 3360 \\ 1680 \\ \hline 20160 \text{ Divisor} \end{array}$$

Now to find the yards per pound of this goods, we add together the $73/1000$ of a pound (weight of filling to one yard of cloth) to the $75/1000$ of a pound (weight of warp to one yard of cloth) and divide 1000 by that product, thus:

(60)

NOTE—In working out the weight of a piece of goods you should not fail to carry your decimal point on through as outlined. It requires several small calculations to figure out what a piece of goods will weigh, yet you will note that this, like all the other examples in this book, is worked down to the plain and simple rules of *addition, subtraction, multiplication and division*, and if you can do that, you will have no trouble to master everything in this book.

CORDED GOODS

Take the pattern as shown and explained in Chapter Six, which has 184 ends for cord work. The cord in this pattern should be run on a separate beam from the rest of the warp, as it will not take-up in weaving like the other part of the warp. In fact, this cord will lay practically straight in the cloth. Therefore, there will be no take-up to allow for these 184 ends. We will figure the weight of this piece of goods, taking the same construction, number of warp and filling, etc., as we used in the preceding example, which would make the goods weigh the same as the piece of goods illustrated in Chapter One, as shown in example on page 60, but for the additional ends required on account of the doubling for cord work which will cause this piece of goods to run a little heavier, as you will note by the following examples:

Total ends in warp	1524
Deducting ends for cord	184
	<hr/>
	1340
	1.15 per cent. size and take-up
	<hr/>
	6700
	1340
	1340
	<hr/>
	1541.00 <i>part of dividend</i>

184 ends cord
1.05 per cent of sizing <i>only</i>
<hr/>
920
184
<hr/>
193.20 other part of dividend

Now for a complete dividend, we add both parts of the dividend together, thus:

$$\begin{array}{r} 1541.00 \\ 193.20 \\ \hline 1734.20 \text{ Dividend} \end{array}$$

For a divisor for the warp we multiply 840 by the number of warp yarn, thus:

$$\begin{array}{r} 840 \\ 26 \text{ No. of warp} \\ \hline 5040 \\ 1680 \\ \hline 21840 \text{ Divisor} \end{array}$$

$\xrightarrow{\text{DIVIDEND}}$ $\xrightarrow{\text{DIVISOR}}$

$$\begin{array}{r} 21840 \overline{) 1734.20} \text{ (.079 of a pound. Weight of one} \\ 1528 \ 80 \qquad \qquad \text{yard of warp} \\ \hline 205 \ 400 \\ 196 \ 560 \\ \hline 8 \ 840 \end{array}$$

Now, as we are to have the same spread in the reed, picks, and number of filling in this piece of goods as we had in the piece as illustrated in Chapter One and as figured out on pages 59 and 60, the weight of *filling* in one yard of this cloth would of course be the same; therefore the weight of this piece of goods would be as follows:

$$\begin{array}{r} 79 \text{ warp} \\ 73 \text{ filling} \\ \hline 152 \overline{) 1000} \text{ (6.57 yards per pound. Weight of goods.} \\ 912 \\ \hline 880 \\ 760 \\ \hline 1200 \\ 1054 \\ \hline \end{array}$$

You will notice that on account of the extra ends used in the corded work in this piece of goods, it will run practically 20 points heavier than the same goods without the corded work; which means that out of every 200 yards

of the goods with the cord you would use about one pound more cotton than you would in the same goods without the cord work. Counting cotton at 10 cents per pound, this would mean about $5/100$ (five one hundredths) of a cent extra cost per yard.

TO FIGURE THE WEIGHT OF GOODS AFTER THEY ARE WOVEN.

Use *yards* for dividend, and *pounds* for a divisor, thus:

$$\begin{array}{r}
 \xrightarrow{\text{YARDS}} \\
 \xrightarrow{\text{POUNDS}} \quad 1024 \overline{) 7103} \quad (6.93 \text{ yards per pound} \\
 \quad \quad \quad 6144 \\
 \quad \quad \quad \hline
 \quad \quad \quad 9590 \\
 \quad \quad \quad 9216 \\
 \quad \quad \quad \hline
 \quad \quad \quad 3740 \\
 \quad \quad \quad 3072 \\
 \quad \quad \quad \hline
 \end{array}$$

Suppose you have one piece of goods $45\frac{1}{4}$ yards long that weighs 6 pounds and 12 ounces. Multiply the yards, $45\frac{1}{4}$, by 16 for a dividend, thus:

$$\begin{array}{r}
 45.25 \text{ equals } 45 \frac{1}{4} \\
 16 \\
 \hline
 271 \ 50 \\
 452 \ 5 \\
 \hline
 724.00 \text{ dividend}
 \end{array}$$

Now multiply the 6 pounds by 16 and then add to this product the other 12 ounces for a divisor, thus:

$$\begin{array}{r}
 \begin{array}{r}
 16 \text{ pounds} \\
 6 \\
 \hline
 96 \\
 12 \text{ ounces} \\
 \hline
 108 \text{ divisor}
 \end{array} \\
 \xrightarrow{\text{DIVIDEND}} \\
 \xrightarrow{\text{DIVISOR}} \quad 108 \overline{) 724.00} \quad (6.70 \text{ yards per pound} \\
 \quad \quad \quad 648 \\
 \quad \quad \quad \hline
 \quad \quad \quad 760 \\
 \quad \quad \quad 756 \\
 \quad \quad \quad \hline
 \quad \quad \quad 40
 \end{array}$$

CHAPTER THIRTEEN

TO FIGURE THE WEIGHT, ETC., OF WARPS

TO FIND THE WEIGHT OF A WARP

For a dividend multiply the number of ends by the number of yards:

$$\begin{array}{r}
 1700 \text{ yards} \\
 1600 \text{ ends} \\
 \hline
 1020000 \\
 1700 \\
 \hline
 2720000 \text{ Dividend}
 \end{array}$$

For a divisor, multiply the number of yarn by 840:

$$\begin{array}{r}
 840 \\
 26 \text{ No. of yarn} \\
 \hline
 5040 \\
 1680 \\
 \hline
 21840 \text{ Divisor}
 \end{array}$$

$$\begin{array}{r}
 21840 \overline{) 2720000} (124.54 \text{ pounds. Weight of warp} \\
 \underline{21840} \\
 53600 \\
 \underline{43680} \\
 99200 \\
 \underline{87360} \\
 118400 \\
 \underline{109200} \\
 92000 \\
 \underline{87360}
 \end{array}$$

TO FIND THE LENGTH OF A WARP

Multiply the weight of the warp by the number of yarn and then multiply that product by 840 for a dividend, thus:

$$\begin{array}{r}
 124.54 \text{ weight of warp} \\
 26 \text{ No. of yarn} \\
 \hline
 747 \ 24 \\
 2490 \ 8 \\
 \hline
 3238 \ 04 \\
 840 \\
 \hline
 12952 \ 160 \\
 259043 \ 2 \\
 \hline
 2719953.60 \text{ Dividend}
 \end{array}$$

For a divisor use the number of ends to the warp as follows:

$$\begin{array}{r}
 \text{Ends in warp} \quad 1600) 2719953.60 (1699.97 \text{ yards long, length of} \\
 \quad \quad \quad 1600 \quad \quad \quad \text{warp} \\
 \hline
 \quad \quad \quad 11199 \\
 \quad \quad \quad 9600 \\
 \hline
 \quad \quad \quad 15995 \\
 \quad \quad \quad 14400 \\
 \hline
 \quad \quad \quad 15953 \\
 \quad \quad \quad 14400 \\
 \hline
 \quad \quad \quad 15536 \\
 \quad \quad \quad 14400 \\
 \hline
 \quad \quad \quad 11360 \\
 \quad \quad \quad 11200 \\
 \hline
 \end{array}$$

TO FIND THE NUMBER OF YARN OF A WARP

Multiply the net weight of the warp by 840 for a divisor, thus:

$$\begin{array}{r}
 124.52 \text{ weight of warp} \\
 840 \\
 \hline
 498 \ 080 \\
 9961 \ 6 \\
 \hline
 10459 \ 6.80 \text{ Divisor (here we cancel the decimal)}
 \end{array}$$

For a dividend multiply the length of the warp in yards by the total number of ends it contains, thus:

1700 yards long
 1600 ends in warp

1020000

1700

2720000 Dividend

104596) 2720000 (26 s number of yarn

209192

628080

627576

CHAPTER FOURTEEN

In order to be able to figure the production of a room or section without going through a long string of calculations each time to do so, it is a good idea to have your *loom* and *cloth constant* to figure from, thus making the work short and simple.

To find your loom constants for 10 hours per day or 60 hours per week, any speed, multiply speed of loom by 6.

Example:

$$\begin{array}{r} \text{Loom speed } 160 \\ \quad \quad \quad 6 \\ \hline 960 \text{ Constant} \end{array}$$

Another example:

$$\begin{array}{r} \text{Loom speed } 170 \\ \quad \quad \quad 6 \\ \hline 1020 \text{ Constant} \end{array}$$

TO FIND CONSTANT FOR CLOTH—ANY LENGTH CUTS

Multiply picks per inch by 36.

Example:

$$\begin{array}{r} 50 \text{ picks per inch} \\ \quad 36 \\ \hline 300 \\ 150 \\ \hline 1800 \text{ constant for 50 pick goods} \end{array}$$

Another example:

$$\begin{array}{r} 56 \text{ pick goods} \\ \quad 36 \\ \hline 336 \\ 168 \\ \hline 2016 \text{ constant for 56 pick goods} \\ (67) \end{array}$$

HOW TO FIND THE PERCENTAGE OF PRODUCTION

First, multiply all the looms run for the week of any one speed by the constant for that speed.

For all the looms you wish to figure on, of different speeds, figure them out as above suggested and add the product of each example together for a divisor, thus: We will suppose we have a section of 60 looms, 30 of which have a speed of 160 pick and the other 30 a speed of 170 pick; we will also suppose now that these 60 looms have run all the week (6 days), so we have—

	30 looms, speed 160—run 6 days
	<u>6</u>
equals	180 looms run one day at 160 pick
	30 looms, speed 170—run 6 days
	<u>6</u>
equals	180 looms run one day at 170 pick
	180 looms run at 160
	<u>960 constant</u>
	10800
	<u>1620</u>
	172800 part of divisor in this case
	180 looms run at 170
	<u>1020 constant</u>
	3600
	<u>180</u>
	183600 other part of divisor in this case
	183600
	<u>172800</u>
	356400 Divisor

For a dividend multiply total yards of each kind of goods woven by the constant for that kind of goods; if more than one kind of goods is woven, add the product of each together; this will give you the dividend, thus: We will suppose we wove on this section for the week the following:

7200 yards of 50 pick goods
 9000 yards of 56 pick goods

NOTE—It makes no difference which looms the goods are woven on, just so it comes off the looms included in our calculations.

7200	yards of 50 pick goods
1800	constant for 50 pick goods
<hr/>	
5760000	
7200	
<hr/>	
12960000	Part of dividend
9000	yards 56 pick goods
2016	constant, for 56 pick goods
<hr/>	
54000	
9000	
18000	
<hr/>	
18144000	the other part of dividend
18144000	
12960000	
<hr/>	
31104000	Dividend

Now divide the dividend by the divisor, which will give a percentage of possible production, thus:

356400)	31104000	(87 per cent. production
	2851200	
	<hr/>	
	2592000	
	2494800	
	<hr/>	

While it has taken right much figuring to make this rule clear to the inexperienced, yet, if you will study it closely you will find after all it is quite simple. The idea, of course, is to get out the constants for the different speeds of looms you happen to be running, also for the different kinds of goods you are running on; and it is only a few minutes work to figure the entire production for a large room, running on quite a mix-up of different speeds and different pick goods. Each section, of course,

is supposed to be worked out on the same basis; if you wish to figure them separately, take the average length of cuts to get at the yards woven on each section of the different kinds of goods.

The entire calculation can be shortened considerably by cutting off the ciphers in the constants; but in taking advantage of this method be sure you cut off the *same number of ciphers or figures in the loom constants* as you do in the *cloth constants*.

A short way, however, to figure the production for a large room, when there are more or less looms of different speeds, first get the average speed.

RULE—Multiply all the looms run of one speed by the speed (picks per minute) and add these products together for a dividend. Then add all the looms run together and take this product for a divisor, thus:

	180	multiplied	by	160	equals	28800
	180	multiplied	by	170	equals	30600
	<hr/>					
Divisor	360			Dividend		59400
	<hr/>					
	360)59400 (165 average speed					
	360					
	<hr/>					
	2340					
	2160					
	<hr/>					
	1800					
	1800					
	<hr/>					

NOTE—Take any number of looms you may happen to have of different speeds and you will get the *average* speed by following the above rule.

165	average	speed of loom
6		
<hr/>		
990	constant for speed of 165 pick	
360	looms run	
<hr/>		
59400		
2970		
<hr/>		
356400	Divisor	

NOTE—By this method you will see we get the same divisor as we have on page 68, which of course will give same results as shown on page 69.

I N D E X

To Find Percentage of Size on Warps.....	56
To Find Take-up in Cloth in Width.....	56
To Find Take-up in Cloth in Length.....	56
To Find Ends Required for Given Width of Cloth.....	57
How to Figure Weight of Goods <i>Before</i> Being Woven.....	58
How to Figure Weight of Goods <i>Before</i> Being Woven (Cord Work)	61
How to Figure Weight of Goods <i>After</i> Being Woven.....	63
How to Figure Weight of Warps.....	64
How to Find Length of Warps.....	64
How to Find Number of Yarn of a Warp.....	65
How to Find Loom Constant.....	67
How to Find Cloth Constant.....	67
How to Figure the Percentage of Production.....	68
How to Find the Average Speed of Looms Running on Dif- ferent Speeds	69-70

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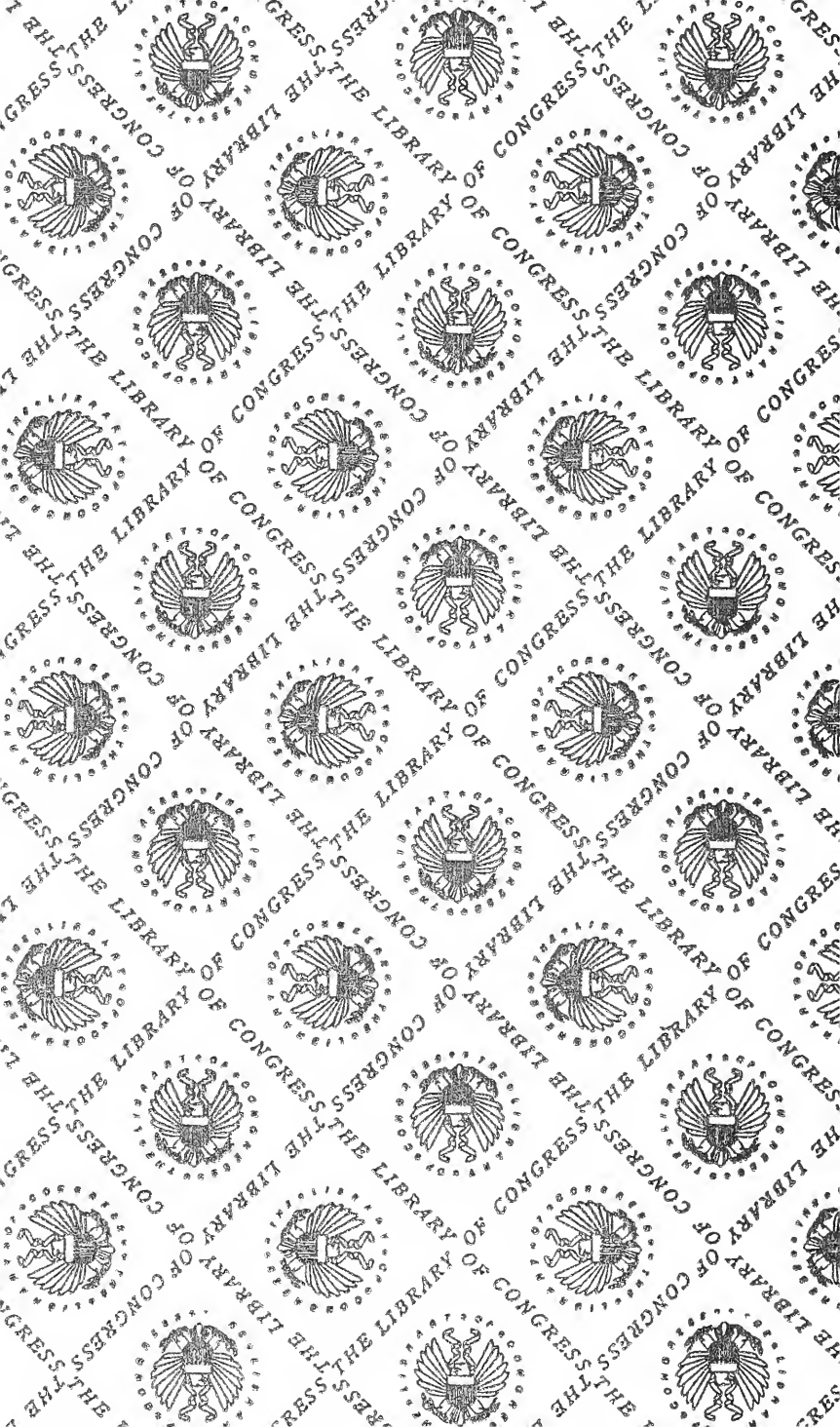
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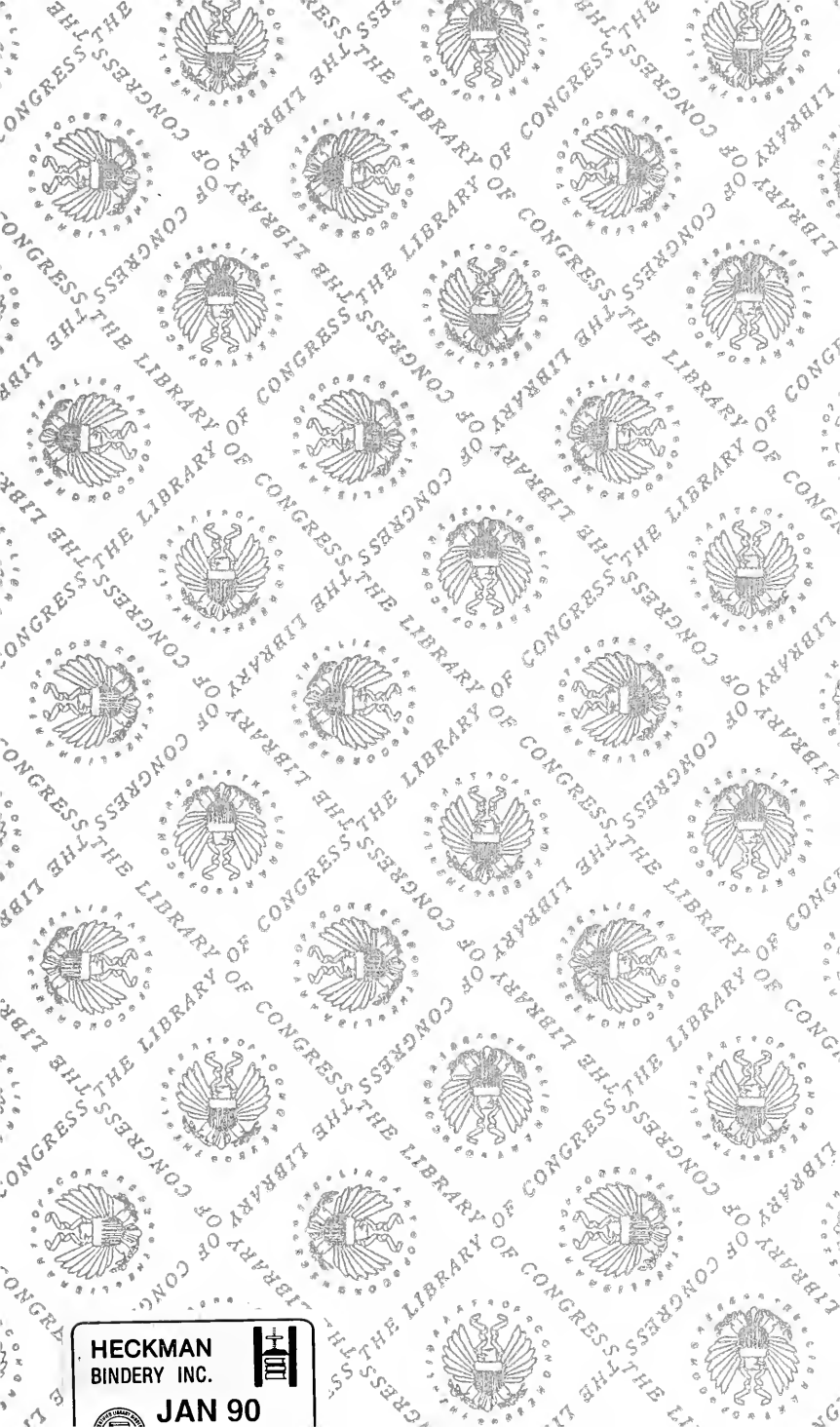
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